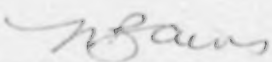
National Research Council Canada

2014–15

Departmental Performance Report



The Honourable Navdeep Bains, P.C., M.P.,
Minister of Innovation, Science and Economic Development

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Minister's Message

We are pleased to report on National Research Council of Canada's key activities in 2014–15.

Our overarching goals within the Innovation, Science and Economic Development portfolio are to help Canadian businesses grow, innovate and export so that they can spur economic development and create good quality jobs and wealth for Canadians in all regions across the country; to help small businesses grow through trade and innovation; to promote increased tourism to Canada; to promote and support scientific research and the integration of scientific considerations in our investment and policy choices. We are committed to working closely with colleagues and stakeholders from all of these diverse fields to achieve these objectives.

We are pleased to present the 2014–15 Departmental Performance Report for National Research Council of Canada.

The Honourable Navdeep Bains
Minister of Innovation, Science and Economic Development

The Honourable Kirsty Duncan
Minister of Science

The Honourable Bardish Chagger
Minister of Small Business and Tourism

President's Message

John McDougall, P.Eng., President

I am pleased to submit for tabling in Parliament, the 2014-15 Departmental Performance Report for the National Research Council of Canada (NRC). We had an exceptional year, filled with important achievements and unexpected challenges. In 2014-15, our commitments were centred on being disciplined in our client-focus, delivery of results to industry and management of our performance (projects, financials, reporting and reviews).

At the beginning of the year, our business momentum was building steadily until we experienced a security breach of our IT infrastructure in July 2014. To mitigate the impacts, NRC immediately implemented a business continuity plan, including the launch of our "Secure NRC" initiative for re-establishing operations in an improved secure environment. NRC progress against its commitments was evidenced by the variety of strategic partnerships we built and strengthened, such as: an agreement to co-develop a new treatment against aggressive brain cancers with a Canadian pharmaceutical company; a joint program with Defence Research and Development Canada (DRDC) and industry partners to develop next-generation products for the international security and defence market; and helping Canadian companies develop projects worth over $46M in EUREKA, an international network for industrial R&D that provides Canadian innovators access to technology, expertise and markets in Europe and beyond.
In parallel with these partnerships, NRC continued to deliver a range of business-driven research, technology and innovation support services to clients through our Industrial Research Assistance Program (NRC-IRAP), with clients reporting 18% growth (in aggregate) of their businesses due to IRAP support and services. NRC also continued to develop and implement business-focused R&D initiatives designed to support Canadian firms in moving innovative ideas and technologies to market more quickly, in such areas as, marine vehicles, biologics, vaccines, therapeutics, transportation, and quantum photonics.

This past year demonstrated NRC's capacity for resilience, innovation and agility to respond to unanticipated challenges and pressures, while continuing to deliver increasingly more valued innovation support and services to Canadian companies.

Section I: Organizational Expenditure Overview

Organizational Profile

Appropriate Minister: Navdeep Bains, Minister of Innovation, Science and Economic Development

- The Honourable James Moore, P.C., M.P. (responsible Minister for 2014-15)

Institutional Head: John McDougall, President

Ministerial Portfolio: Innovation, Science and Economic Development

Enabling Instrument(s): *National Research Council Act*[1], R.S.C. 1985, c. N-15

Year of Incorporation / Commencement: 1916

Other: NRC is a departmental corporation of the Government of Canada, reporting to Parliament through the Minister of Industry. NRC works in partnership with members of the Industry Portfolio to leverage complementary resources to promote innovation, to exploit synergies in key areas of S&T, to promote the growth of small and medium-sized enterprises (SMEs) and to contribute to Canadian economic growth. NRC's Council provides independent strategic direction and advice to the NRC President and reviews organizational performance. The President provides leadership and strategic management and is responsible for the achievement of NRC's long-range goals and plans. Each of NRC's seven Vice Presidents is responsible for a number of areas composed of research sub-programs, initiatives, centres, the Industrial Research Assistance Program, and/or a corporate branch. Vice Presidents and NRC managers are responsible for executing plans and priorities to ensure successful achievement of objectives.

Organizational Context

Raison d'être

The National Research Council Canada (NRC) bridges the innovation gap between early stage research and development (R&D) and commercialization, focusing on socio-economic benefits for Canada and increasing national performance in business-led R&D and innovation. A federal leader in technology development, NRC supports Canadian industry to enhance their innovation capabilities and capacity and become more productive in the development and deployment of innovative products, processes and services for markets of national priority and importance. With a presence in every province, NRC combines its strong national foundation with international linkages to help Canada grow in productivity and remain globally competitive. NRC works in collaboration with industry, governments and academia to maximize Canada's overall R&D investment.

Responsibilities

Under the *National Research Council Act*[2], NRC is responsible for:

- Undertaking, assisting or promoting scientific and industrial research in fields of importance to Canada;
- Providing vital scientific and technological services to the research and industrial communities;
- Investigating standards and methods of measurement;
- Working on the standardization and certification of scientific and technical apparatus and instruments and materials used or usable by Canadian industry;
- Operating and administering any astronomical observatories established or maintained by the Government of Canada;
- Establishing, operating and maintaining a national science library; and
- Publishing and selling or otherwise distributing such scientific and technical information as the Council deems necessary.

NRC VISION

To be the most effective research and technology organization (RTO) in the world, stimulating sustainable domestic prosperity.

NRC MISSION

Working with clients and partners, we provide innovation support, strategic research, scientific and technical services to develop and deploy solutions to meet Canada's current and future industrial and societal needs.

Strategic Outcomes and Program Alignment Architecture

1. Strategic Outcome (SO1): Canadian businesses prosper from innovative technologies

- **1.1 Program:** Technology Development and Advancement (TD&A)
  - **1.1.1 Sub-Program:** Aerospace
  - **1.1.2 Sub-Program:** Automotive and Surface Transportation (AST)
  - **1.1.3 Sub-Program:** Ocean, Coastal and River Engineering (OCRE)
  - **1.1.4 Sub-Program:** Energy, Mining and Environment (EME)
  - **1.1.5 Sub-Program:** Construction
  - **1.1.6 Sub-Program:** Aquatic and Crop Resource Development (ACRD)
  - **1.1.7 Sub-Program:** Medical Devices (MD)
  - **1.1.8 Sub-Program:** Human Health Therapeutics (HHT)
  - **1.1.9 Sub-Program:** Information and Communications Technologies (ICT)
  - **1.1.10 Sub-Program:** Security and Disruptive Technologies (SDT)
- **1.2 Program:** Industrial Research Assistance Program (IRAP)

2. Strategic Outcome (SO2): R&D infrastructure for an innovative and knowledge-based economy

- **2.1 Program:** Science Infrastructure and Measurement (SI&M)
  - **2.1.1 Sub-Program:** National Science Infrastructure (NSI)
  - **2.1.2 Sub-Program:** Measurement Science and Standards (MSS)

Program: Internal Services

Organizational Priorities

Priority 1	Type[1]	Strategic Outcome
Generate demonstrable results for clients through market-driven research, technology development and innovation support services – with a focus on supporting commercialization – to help Canadian firms thrive in today's globally competitive, innovation-based economy.	New	SO1: Canadian businesses prosper from innovative technologies

Summary of Progress
• NRC participated in strategic research partnerships to provide clients with funding and expertise in areas of photonics, vaccines, biopharma, and medical devices in particular. For example, one partnership involving a biopharma consortium led to funding for two of NRC's SME clients (British Columbia's biOasis Technologies Inc. and Ontario's KaiGene Pharmaceuticals Inc.) to develop innovations against brain diseases with NRC's Human Health Therapeutics (HHT) sub-program. Other partnerships are helping clients bring innovations to market faster and with better results. Quebec's Raymor Industries, for example, was recognized internationally for novel semiconducting nanotube ink – a potentially disruptive innovation for the flexible electronics industry that was developed in collaboration with NRC's Information and Communication Technologies (ICT) sub-program. In addition, NRC-IRAP Concierge established partnerships with several federal departments to facilitate SME access to innovation programs and services. • NRC collaborated with globally-renowned technology leaders and Canadian SMEs to increase Canadian content in multi-national supply chains. Projects for developing cost-efficient green technologies were undertaken in all major industry sectors, including residential and commercial construction. NRC's international strategy identified partners with a high potential for impact on Canadian industry and executive-level relationships were developed with Finland, Norway, Korea and others to further collaborations and client objectives. • NRC manages Canada's national office for EUREKA, an intergovernmental network for market-driven industrial R&D. EUREKA includes over 40 economies from the EU, Canada, Israel, and South Korea. Through associate membership in EUREKA, Canadian innovators were successful in accessing technology, expertise, and markets in these lucrative markets. With NRC's support, Canada grew its portfolio of EUREKA cluster projects to 38 (valued at over 33M Euros), making Canada one of EUREKA's most active network project participants. • IRAP supported innovation by providing SMEs with technical and business advice and funding for innovation projects. In aggregate, post-project surveys indicated that client business revenue grew by 17% due to IRAP's support.

1 Type is defined as follows: previously committed to—committed to in the first or second fiscal year prior to the subject year of the report; ongoing—committed to at least three fiscal years prior to the subject year of the report; and new—newly committed to in the reporting year of the RPP or DPR.

Priority 2	Type	Strategic Outcome
Enhance the generation and commercialization of knowledge in Canada by providing integrated scientific support and infrastructure	Ongoing	SO2: R&D infrastructure for an innovative and knowledge-based economy

Summary of Progress

- NRC continued to provide and enhance state-of-the-art infrastructure for Canada's knowledge-based economy. NSI demonstrated breakthrough performance of a prototype composite reflector antenna system (called Dish Verification Antenna, or DVA-1) that is 30% more sensitive than other antennas. This technology is developed in conjunction with industrial partners for next-generation radio telescopes. In addition to the commercialization potential, the completed technology is expected to deliver clearer views of more distant objects for better understanding of the universe.
- NSI's Canadian Astronomy Data Centre delivered over 38 million astronomy files to users. Roughly 8,300 professional astronomers downloaded files comprising 1,080 Terabytes of data, highlighting the continued relevance and demand for astronomy infrastructure.
- MSS provides the measurement standards underlying domestic and international trade. In 2014-15, over 785 clients from industry and government accessed NRC's services and expertise and more than 2054 calibration and other reports were delivered to clients. November 2014 marked the 75th anniversary of the NRC time signal, which is the key element of the daily 1:00 pm time transmission on CBC and is the longest running Canadian radio program, used by Canadians and businesses to set their clocks.
- NRC provided funding to the TRIUMF[4] national laboratory for sub-particle physics. TRIUMF completed the construction of a $62.9M facility that expands Canada's capabilities to produce and study isotopes for physics and medicine.
- NRC led a multi-year project to implement the Federal Science Library (FSL) across seven federal government departments. Substantial progress was made during 2014-15 in building a modern digital service supporting federal science, technology and health initiatives. FSL is an Open Government Action Plan 2.0[5] commitment.
- NRC facilitated public access to federal science library collections through partnership with Libraries and Archives Canada[6]. Canadian clients received over 16,000 documents from these collections in 2014-15.
- NRC provided library expertise and service delivery support to 8 federal science based departments and agencies through 12 agreements.

Priority 3	Type	Strategic Outcome
Drive organizational growth to deliver on expected results and enable effective and efficient resource management for a sustainable organization.	Previously committed to	SO1: Canadian businesses prosper from innovative technologies, and SO2: R&D infrastructure for an innovative and knowledge-based economy

Summary of Progress

- NRC improved its approach to attract and hire talent. It also implemented an exercise to support succession planning within the executive ranks and developed and launched an initiative for managing high potential employees and critical positions across NRC. In addition, NRC developed comprehensive staffing plans and workforce strategies to address future competency gaps.
- A quarterly reporting process was piloted in 2014-15 across 13 NRC R&D initiatives to provide senior executives with an objective assessment of progress made against plans, covering such aspects as governance, financial management, risk management, business development, market changes, milestone achievement, and technology deployment. Plans were made to fully implement the quarterly reporting process in early 2015-16.
- A major project was underway in 2014-15 to streamline NRC's internal services from a process perspective. The project was suspended temporarily following the cyber-intrusion so that resources could be reassigned to business recovery.

Risk Analysis

Progress made in FY 2010-11 against the top externally-oriented risks include the following:

Key Risks

Risk	Risk Response Strategy	Link to P&R
Delivery of Results for Clients and Canada: Risk that NRC is unable to effectively execute its programs and deliver expected results for clients and Canada.	• Launched first round of platform reviews to assess health and direction of existing research initiatives. • Implemented advisory boards for R&D initiatives to resolve operational challenges. • NRC's cyber intrusion slowed down business momentum and affected timely delivery on client commitments. Work around limited these negative impacts.	SO1 and SO2
NRC Longer-Term Competitiveness & Relevance to Clients: Risk that NRC is not proactively building the longer-term capabilities required to attract relevant Canadian and international firms with a Canadian footprint to create future impacts for Canadian industry and the economy.	• New R&D program opportunities were proposed, and broad consultations undertaken to identify areas for potential NRC focus. Implemented tools with global reach, such as social media to access foreign talent pools. • Benchmarked NRC with other research and technology organizations worldwide, providing insights on opportunities for improved performance. • NRC's client survey identified scientific knowledge as the strongest reason (66%) for choosing NRC.	SO1 and SO2
Sourcing and Management of Technical and Business Expertise: Risk that NRC is not proactively building the longer-term capabilities required to attract relevant Canadian and international firms with a Canadian footprint to create future impacts for Canadian industry and the economy.	o Improved talent acquisition strategy and onboarding. o Identified critical positions for priority hiring. • Implemented succession planning for senior leaders. • Employee-driven turnover remained stable at 4.2%.	SO1 and SO2

Actual Expenditures

Budgetary Financial Resources (dollars)

2014-15 Main Estimates	2014-15 Planned Spending	2014-15 Total Authorities Available for Use	2014-15 Actual Spending (authorities used)	Difference (actual minus planned)
896,432,878	918,305,859	1,132,206,668	955,704,916	37,399,057

Human Resources (Full-Time Equivalents [FTEs])

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
3,592.0	3,577.1	-14.9

Budgetary Performance Summary for Strategic Outcomes and Programs (dollars)

Strategic Outcome(s), Program(s) and Internal Services	2014-15 Main Estimates	2014-15 Planned Spending	2015-16 Planned Spending	2016-17 Planned Spending	2014-15 Total Authorities Available for Use	2014-15 Actual Spending (authorities used)	2013-14 Actual Spending (authorities used)	2012-13 Actual Spending (authorities used)	2014-15 Difference (Actuals minus Planned)
Strategic Outcome 1: Canadian businesses prosper from innovative technologies									
Program 1.1: Technology Development and Advancement	**331,740,362**	**339,268,474**	**289,693,954**	**308,400,163**	**424,031,453**	**344,930,416**	**317,721,198**	**281,874,311**	**5,663,942**
Program 1.2: Industrial Research Assistance Program	260,499,279	270,670,144	293,359,644	265,841,644	301,733,723	271,824,267	278,130,653	244,628,683	1,154,123
Subtotal	592,239,641	609,938,618	583,053,598	574,241,807	725,765,176	616,754,683	595,851,851	508,502,994	6,818,065
Strategic Outcome 2: R&D infrastructure for an innovative and knowledge-based economy									
Program 2.1: Science Infrastructure and Measurement	100,720,529	101,777,277	78,268,299	79,660,370	117,794,792	108,451,583	99,678,744	94,893,647	4,674,306
Strategic Outcome 2 Subtotal	100,720,529	101,777,277	78,268,299	79,660,370	117,794,792	108,451,583	99,678,744	94,893,647	4,674,306
Internal Services Subtotal	203,472,708	206,591,964	203,548,420	202,656,329	288,646,700	232,498,650	198,887,611	203,408,271	25,906,686
Total	896,432,878	918,305,859	864,870,317	856,758,506	1,132,206,668	955,704,916	894,418,206	804,804,912	37,399,057

Summary Financial Resource Analysis: The National Research Council of Canada reported a total planned spending of $918.3 million for fiscal year 2014-15 and incurred total expenditures of $955.7 million. The increase in spending of $37.4 million primarily relates to:

- Treasury Board funded payroll costs of $32.2 million;
- Investing on its IT infrastructure as a result of the cyber-intrusion of $23.3 million;
- Transition payment for implementing salary payments in arrears by the Government of Canada of $11.7 million;

- Offset by a reduction in Statutory Revenue spending of $62.6 million; and
- The remaining balance of $32.8M is principally related to the additional costs associated with the ratification of collective agreements.

Alignment of Spending with the Whole-of-Government Framework

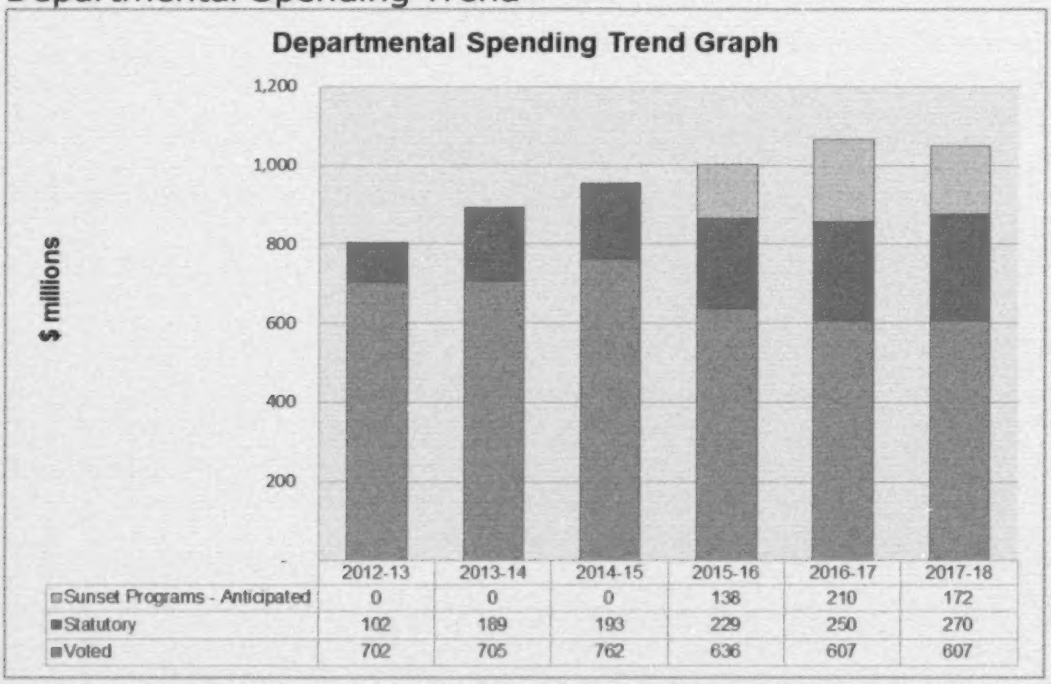
Alignment of 2014-15 Actual Spending with the Whole-of-Government Framework[vi] (dollars)

Strategic Objective	Program	Spending Area	Government of Canada Outcome	2014-15 Actual Spending
SO1: Canadian businesses prosper from innovative technologies	1.1 Technology Development and Advancement	Economic Affairs	Strong Economic Growth	344,930,416
	1.2 IRAP			271,824,267
SO2: R&D infrastructure for an innovative and knowledge-based economy	2.1: Science Infrastructure and Measurement		Innovative and Knowledge-based Economy	106,451,583

Total Spending by Spending Area (dollars)

Spending Area	Total Planned Spending	Total Actual Spending
Economic Affairs	711,713,895	723,206,266
Social Affairs	0	0
International Affairs	0	0
Government Affairs	0	0

Departmental Spending Trend



	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Sunset Programs - Anticipated	0	0	0	138	210	172
Statutory	102	189	193	229	250	270
Voted	702	705	762	636	607	607

Spending Trend Analysis: NRC's spending trend increased due to the implementation of various Budget initiatives in Budget 2012 to Budget 2015 related to infrastructure and contributions funding (IRAP, CAIP, BIAP, Thirty Meter Telescope and the Youth Employment Program). Another factor contributing to the rise in spending relates to the amount of growth planned in Statutory Revenue spending due to NRC's realignment to industry focused research. NRC's funding profile includes sunsetting programs, including research and development funding for a realigned NRC, TRIUMF sub-atomic research facility, Federal Infrastructure Initiative and the Thirty Meter Telescope. Planned spending does not reflect future budget decisions.

Expenditures by vote

For information on NRC's organizational Votes and statutory expenditures, consult the *Public Accounts of Canada 2015* on the Public Works and Government Services Canada website[vii].

Section II: Analysis of Programs by Strategic Outcome

Strategic Outcome 1: Canadian businesses prosper from innovative technologies

Program 1.1: Technology Development and Advancement (TD&A)

This program develops and advances technologies to enhance the prosperity of Canadian industries in support of federal priorities such as the federal Science and Technology Strategy. This includes national-scale flagship technology-development initiatives having sufficient critical mass to contribute demonstrably to national prosperity. To bring new and innovative products and processes to the marketplace, companies must advance the emerging and maturing technologies embodied in applied developments and prototypes to a level where the risk is sufficiently reduced to be accepted from the business, investment, and regulatory perspectives. The program bridges this critical technology gap through mission-oriented research and development services, and specialized technical services such as custom design and fabrication, testing, prototyping, up-scaling, and demonstration in specialized facilities.

Budgetary Financial Resources[2] (dollars)

2014–15 Main Estimates	2014–15 Planned Spending	2014–15 Total Authorities Available for Use	2014–15 Actual Spending (authorities used)	2014–15 Difference (actual minus planned)
331,740,362	339,266,474	424,031,453	344,930,416	5,663,942

Human Resources[2] (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
2007.0	1999.6	-7.4

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Canadian industries commercialize advanced technologies	Client/stakeholder deployment of technology	14 annually by March 2015	At least 12 clients announced intentions in 2014-15 to exploit technologies already developed with or by the Program.
	Client/stakeholder feedback on benefits: jobs, sales, R&D	80% annually by March 2015	90% of 117 respondents reported benefits from the Program

[2] In the 2014-15 RPP, spending and FTEs for common services in support of sub-programs were excluded from sub-programs totals. However, in this document (DPR), spending and FTEs for common services in support of sub-programs were included in sub-program totals. As such, this change in methodology increases the spending and FTEs numbers for sub-programs in this document (DPR).

Performance Analysis and Lessons Learned

TD&A delivered technical and advisory services that addressed clients' shorter-term technical problems associated with the transfer, adoption and diffusion of technology. It also participated in collaborative research to accelerate development and deployment timelines. To protect commercial interests, the present report respects constraints on disclosure of proprietary work.

Client satisfaction remained high. Over 90% of surveyed R&D clients reported that the Program met expectations. In terms of impacts, 53% of them reported increased innovation capacity; 14% created jobs while 11% increased sales as results of collaborating with NRC. Moreover, 55% reported increased knowledge and ability to plan and execute R&D projects.

The pace of technology development and client investment were lower than expected due to the cyber-intrusion. Given that technology development is a long-term process, the Program nonetheless saw its efforts, for at least 12 technologies, progress to the point of industry disclosure of intents to exploit them commercially. Examples include:

- Innovative construction products – Successful tests by the Construction sub-program facilitated commercialization of a novel system by BC's Radon Environmental for managing the impacts of radon gas entering basements.
- Logiag soil analyser – Logiag took steps to deploy commercially its innovative laser-based soil-testing technology following successful R&D collaboration with NRC's EME facility in Boucherville, QC. The technology placed Logiag amongst the four finalists in a provincial innovation competition.
- Printable electronics – Raymor Industries commercialized and won an innovation award for novel semiconductor inks developed with NRC.
- Medical devices - Calgary's Kent Imaging adopted NRC technology into its novel instrumentation that gauges healing without touching or disturbing tender wounds. Similarly, Quebec's Handyem Inc. adopted NRC miniaturization technology into a uniquely portable instrument that counts and sorts cells, and detects biomarkers important for identifying disease.
- Parathyroid hormone - Adopting a production process that was developed with support from NRC's HHT sub-program, NPS Pharmaceuticals received regulatory approval to commercialize Natpara® , the world's first hormone for hypoparathyroidism, which affects calcium in blood and bone.
- Biogas – NRC provided engineering, design and testing services that helped a BC start up, Quadrogen Power System to enter the US market and position it to commercialize on a global basis its technology for removing impurities in biogas.
- Quantum computing – A new company (Quantum Silicon Inc.) was created to commercialize next-generation ultra-fast and ultra-lean computing technology developed in collaboration between NRC and the University of Alberta.
- Optical communication – NRC assisted Quebec-based TeraXion to develop a transmitter that communicates at breakthrough speeds on optical fibre networks, helping establish TeraXion as a major player in global telecommunications.

Sub-Program 1.1.1: Aerospace

This sub-program advances product and process technologies to enhance the prosperity of the aerospace industry sector in Canada that is striving to remain competitive in the face of razor-thin margins and increasing regulatory demands. The sector is important to the Canadian economy as a major contributor to manufacturing trade and for hundreds of thousands of skilled jobs at all levels of the supply chain. It is also important for its impacts on the transportation costs of materials and products that drive the economy. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services in specialized facilities, such as testing and prototyping, for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
54,793,852	66,015,920	11,222,068

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
313.0	382.5	69.5

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements of aerospace process and product technologies	Client/stakeholder financial investment in technology development, $ millions	$37.0M annually by March 2015	$31.2M [3]
	Licensing and royalty revenue from NRC clients, $ millions	$0.05M annually by March 2015	$0.04M

[3] The Aerospace sub-program experienced lower than expected client engagement in some cases in particular due to a large OGD client experiencing budget reductions

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $31.2M in financial investments during 2014-15 towards the advancement of technologies ($24.6M technical services and $6.6M collaborative research).

Highlights from 2014-15 include:

- An advanced helicopter seat cushion was developed for National Defence (DND) to counter the extreme forces and vibrations experienced by helicopter crews. The cushion reduces whole-body vibration, which has been shown to affect health and performance. DND has scheduled deployment of the cushions in its Griffon helicopter fleet. NRC licensed the technology to DART Aerospace in Hawkesbury, Ontario for deployment in the commercial helicopter market, enabling employment growth in the company.
- New rules were published by aerospace regulators in the fall of 2014 for manufacturers to certify their engines for operation under atmospheric conditions that can lead to accumulation of ice in aircraft engines. This positive development was supported by earlier work by the sub-program in developing and deploying technologies to help aerospace regulators and the industry understand the complex atmospheric conditions that can lead to icing. To address evolving certification requirements, another NRC technology was refined and tested in 2014-15 for detecting dangerous ice accumulation in aircraft engines. Based on the successful results of this early work, plans were made to conduct further tests that, if successful, would support commercialization of the technology in the global market.
- The sub-program leveraged NRC's video-recognition capabilities to optimize the flight-training capabilities of CAE Aerospace, based near Montreal. As a result, the company's flight-test program for pilots of the S-92 Sikorsky aircraft was shortened by over 40 days.
- Successful completion of tests at the sub-program's facilities enabled Bombardier Aerospace to advance to the final stage towards certification of its Challenger 350 aircraft, which is poised to increase Canada's share of the global market for fuel-efficient business jets.
- The sub-program successfully demonstrated the feasibility and cost savings of thermal sprays for certain repairs of aircraft components. Tests revealed that the technology allows for quicker and more economical repairs thereby allowing higher margins or more competitive pricing. Likewise, the sub-program demonstrated a technology that reduces waste during manufacture of aircraft parts. This too improves the position of Canadian companies in the highly competitive global aerospace market.

Additional information is available on the sub-program's website[viii].

Sub-Program 1.1.2: Automotive and Surface Transportation (AST)

This sub-program provides technical knowledge and it advances product and process technologies for producing more fuel-efficient, affordable, and environmentally-responsible ground vehicles and for delivering engineering solutions to complex technology challenges facing surface transport industries including heavy vehicle and rail. This is important for reducing transportation infrastructure and costs and for enhancing Canada's share of ground vehicle supply chains and for enhancing the prosperity of the ground vehicle industry sector in Canada as it is faced with growing environmental concerns, competitive pressures, and stringent regulations. The Canadian economy relies on ground vehicle industries as major economic drivers, accounting for a significant portion of manufacturing trade, and therefore must remain competitive. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services, such as testing, prototyping and system integration, for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
45,698,353	44,756,679	(941,674)

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
248.0	250.2	2.2

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements in ground vehicle process and product technologies	Client/stakeholder financial investment in technology development, $ millions	$27.0M annually by March 2015	$19.8M [4]
	Licensing and royalty revenue from NRC clients, $ millions	$0.45M annually by March 2015	$0.70M

[4] The AST sub-program experienced a slow-down in client engagement due to external factors.

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $19.8M in financial investments during 2014-15 towards the advancement of technologies ($12.7M technical services, $6.4M collaborative research, $0.7M licensing and royalties).

Highlights from 2014-15 include:

- Under AST's leadership, the ALTec Consortium[IX] grew to include 5 companies plus two partner organizations across the automotive supply chain, sharing costs and know-how to develop and promote aluminum technologies for lighter and more efficient vehicles. With a shared commitment of $750K over the next 4 years, the Consortium's activities in 2014-15 included developing advanced moulds and welding techniques that optimize manufacturing processes.

- AST perfected a process for transforming Canadian flax into "green" composite materials for applications in mass transit such as interior parts for bus, train and aircrafts. The resulting bio-material led to a product with improved properties compared to mats made of European flax, which is considered as the best reference material. Improved characteristics include mechanical strength plus fire and moisture resistance. This achievement represents a critical step in market penetration of bio-based composites for Canadian companies, as well as creating an effective sustainable Canadian supply chain of reliable bio-based materials.

- NRC collaborated with two Canadian companies (a raw material supplier plus a parts manufacturer) to design systems that reduce the manufacturing cost of electric motors for electric vehicles. The new technology resulted in the design of lower-cost electric motors giving the Canadian companies a competitive edge while helping to hasten market adoption of "clean" electric transportation.

- AST and Transport Canada agreed formally to collaborate on improving safety of rail rolling stock and rail infrastructure in Canada. During 2014-15, four large R&D projects were initiated under this arrangement.

Additional information is available on the sub-program's website[X].

Sub-Program 1.1.3: Ocean, Coastal, and River Engineering (OCRE)

This sub-program develops and advances technologies and standards for safe and effective operations in Canada's vast ocean, coastal and river environments, including the Arctic. This is important for lowering barriers for natural resource development and for enhancing the prosperity of the Canadian marine transportation and water resource sectors facing costly challenges of harsh environments (ice, wind, waves, currents), extreme weather events (floods, "100 year wave"), and coastal erosion. Results are achieved by working with Canadian industry through multi-disciplinary collaborative research and development services in addition to specialized technical services, such as testing, prototyping, numerical modeling, and system integration in specialized facilities, for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
15,648,736	18,414,080	2,765,344

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
81.0	112.3	31.3

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements of process and product technologies for ocean, coastal and inland water engineering	Client/stakeholder financial investment in technology development, $ millions	$12.0M annually by March 2015	$8.7M[5]
	Licensing and royalty revenue from NRC clients, $ millions	$0.05M annually by March 2015	$0.11M

[5] The OCRE program experienced program execution challenges which led to some delays in client project delivery.

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $8.7M in financial investments during 2014-15 towards the advancement of technologies ($6.5M technical services, $2.1M collaborative research, $0.1M licensing and royalties).

OCRE explored new opportunities to collaborate with other agencies for northern housing and to contribute to planning the Canadian High Arctic Research Station. Highlights from 2014-15 include the following:

- OCRE collaborated with industry and government toward facilitating safe and efficient transit in the Arctic as well as in improving knowledge of the region for future development. For example, OCRE played a lead role in developing the Canadian Arctic Shipping Risk Assessment System (CASRAS), which identifies dangerous build-ups of ice, or pressured ice conditions, which can beset vessels. Until recently, no reliable method could predict these conditions. Such developments earned OCRE the reputation as a world pioneer in ice forecasting, developing characterizations of pressured ice and quantifying the ability of ships to navigate such treacherous conditions.

> *"NRC wanted to achieve a solution that would work best for us, considering everything from the environment we worked in to the tools we worked with."*
> - Captain Fowler, Canadian Coast Guard.

- OCRE supported Canada's $35-billion investment in the National Shipbuilding and Procurement Strategy. Examples include development work for equipping Canada's submarine fleet with an advanced autopilot system. As of March 2015, a prototype was built and tests were conducted in NRC's tow tank – the largest of its kind in Canada.
- The NRC officially launched a new Arctic Program to develop low-impact technologies to further economic and industrial development of Canada's vast northern regions. The program has four priority areas: resource development, northern transportation and shipping, marine safety technologies, and community infrastructure.

Additional information is available on the sub-program's website[ii].

Sub-Program 1.1.4: Energy, Mining and Environment (EME)

This sub-program develops and advances technologies and techniques for enhancing the innovation capacity and growth of Canada's natural resources and utility sectors. These sectors are important contributors to Canada's GDP that are challenged by volatile global markets and growing environmental pressures. To remain sustainable, industries in these sectors require technologies to reduce production costs. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized advisory and technical services for transforming or advancing technologies into industrial solutions for the marketplace.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
25,045,360	27,584,070	2,538,710

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
164.8	173.3	8.5

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements of process and product technologies for the natural resources and utility sectors	Client/stakeholder financial investment in technology development, $ millions	$10.0M annually by March 2015	$8.1M[1]
	Licensing and royalty revenue from NRC clients, $ millions	$0.5M annually by March 2015	$0.215M

[1] EME sub-program client investment was impacted by unforeseen changes in the energy and mining market affecting client needs and activities; some adjustments to activities were required after the initial implementation phase in the light of the market changes.

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $6.1M in financial investments during 2014-15 towards the advancement of technologies ($2.1M technical services, $3.6M collaborative research, $0.3M licensing and royalties).

> "We're now saving about $1M per broadbar (ore processing plant) per year, and we see seven breakers in our operations."
> - Lin Parent, Suncor Energy

Highlights from 2014-15 include:

- In-depth knowledge on wear and corrosion resistant materials under different application conditions was applied to solve a severe wear problem in a Shell Canada processing plant for mined oil sands. As a result, component service life was increased from two months to four months, leading to annual savings exceeding $1122M including avoided downtime, labour and materials.
- Application of innovative sensor technologies for monitoring process streams in metallurgical and mineral processing plants was demonstrated for the mining industry, taking NRC sensor technology a step closer to enabling improved efficiency and reduced cost.
- With engineering, design, and testing help from EMR, BC's Quadrogen Power Systems commercialized a technology that produces the world's cleanest biogas from landfill. Consequently, Quadrogen is now becoming a global contender in bioenergy, exporting to the USA and abroad.
- In collaboration with operator and supplier companies, EMR conducted assessments and accelerated testing tools to support future integration of energy storage technologies into Canada's power transmission grid. Anticipated benefits include validated storage solutions implemented over the next 5 years, helping utilities manage intermittent generation and consumption at reduced cost.
- Technical characterization, testing services, modifications and optimization for extraction and use of biofuels were provided to the Bioenergy sector in Canada as it addressed the technical and market challenges of introducing new "green" technologies and proving their economic impact. Declining fossil fuel prices have delayed the competitiveness of these alternatives requiring additional emphasis on sound assessment of economic potential. Opportunities for remote communities, for waste-to-energy systems, for gasification and for novel solid biofuels were successfully assessed for potential future implementation by the industry sector.

Additional information is available on the sub-program's website[48].

Sub-Program 1.1.1: Construction

This sub-program provides technical knowledge and advanced product and process technologies to enhance the productivity of the Canadian construction industry sector as it faces critical challenges in responding to opportunities for better performing and more affordable buildings and infrastructure while striving to remain competitive in the global marketplace. The success of this sector is critical as a major contributor to Canada's GDP, employing millions of individuals, and managing assets valued in the trillions of dollars. Results are achieved through multi-disciplinary collaborative research and development and demonstration services in addition to specialized technical services – such as testing, product and process validation, prototyping, and expert assistance in field and in specialized facilities – for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2014-15 Planned Spending	2014-15 Actual Spending	2014-15 Difference (actual minus planned)
25,812,137	26,990,492	1,178,355

Human Resources (FTEs)

2014-15 Planned	2014-15 Actual	2014-15 Difference (actual minus planned)
155.0	157.0	1.0

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements of process and product technologies for the construction industry sector	Client/stakeholder financial investment in technology development, $ millions	$12.0M annually by March 2015	$11.4M
	Licensing and royalty revenue from NRC clients, $ millions	$0.04M annually by March 2015	$0.05M

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $11.4M in financial investments during 2014-15 towards the advancement of technologies ($4.2M technical services, $4.1M collaborative research, $0.7M licensing and royalties, and $2.4M other[7]). The year represented the low point of NRC's 5-year sales royalty cycle for building code products. Royalty revenue is expected to increase with the release of the 2015 *National Model Codes* in 2015-16. Demand for technical services for validating the performance of building technologies remained high, with over 50 innovative products validated for over 30 industrial clients, increasing their access to construction markets that demand objective evidence of product performance.

- The sub-program demonstrated the performance of large-scale energy management systems, next generation roof-mounted photovoltaic systems, ultra-high performance insulation systems for low sloped roofs, and novel building coatings for solar load control. Successful demonstration of an intelligent load management technology for electrical heating inspired two Canadian SMEs to develop prototypes of new automated demand response thermostats.
- The sub-program finalized the updated technical content of the *2015 National Model Codes* to permit provinces and territories to enact technically robust and economically efficient regulation.
- Market adoption of vegetative or "green" roof technologies and solid-state lighting was supported through new product standards based on NRC research in these areas.
- The sub-program worked with the construction industry in advancing technologies for economical mid-rise buildings. This included fire demonstrations of a wooden elevator shaft, in collaboration with provincial and federal government departments to facilitate approval of Canada's first tall wood buildings. Moreover, this work supported changes in the upcoming release of the *2015 National Building Code*, creating more opportunities for growth in the midrise wood building market.
- The sub-program progressed in advancing more durable concrete structures to extend service life and to reduce operating costs of Canada's vast highway and urban infrastructure. A 125-year durability and service life Evaluation Framework was prepared to assess proposals for the construction and maintenance of the new St Lawrence Seaway Bridge in Montreal. Together with earlier advances in high-strength concrete, and bridge monitoring and protection technologies, this new evaluation protocol is a significant step forward towards realizing the cost-effective and durable bridge, thereby significantly reducing owners' life-cycle costs and infrastructure costs to all Canadians.

Additional information is available on the sub-program's website[xiii].

[7] "Other" revenue includes revenue derived from one or more of: sales of goods (model construction codes), lease and use of property and equipment, and grants and contributions.

Sub-Program 1.1.6: Aquatic and Crop Resource Development (ACRD)

In collaboration with industry, this sub-program develops improved varieties of crops and develops technologies for maximizing crop value and converting biomass to enhance the prosperity and global market share of the Canadian agriculture, bio-product, and natural health product industry sectors. This includes development and validation of value-added goods – from natural ingredients and health products through to chemicals and industrial oils and other products – for leveraging Canada's abundance of aquatic and crop resources. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
37,095,459	33,008,836	(4,086,623)

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
214.0	198.4	-15.6

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements in agricultural crops and related value-added products	Client/stakeholder financial investment in technology development, $ millions	$5.5M annually by March 2015	$4.7M
	Licensing and royalty revenue from NRC clients, $ millions	$0.32M annually by March 2015	$1.17M

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $4.7M in financial investments during 2014-15 towards the advancement of technologies ($1.9M technical services, $1.4M collaborative research, $1.2M licensing and royalties, and $0.2M other[8]). In particular, demand for technical services in profiling of hormones has increased steadily with financial investments of $0.6M in 2014-15 from 17 new clients from Canada's plant agriculture sector. In addition, royalty payments increased significantly to $1.17M up from $0.3M in 2013-14, due primarily to assignment of legacy intellectual property.

- ACRD collaborated with Ontario's Next Remedies to develop a novel manufacturing process for liquid dietary supplements prepared from insoluble ingredients such as coenzyme Q10, which can neutralize free radicals, one of the causes of aging. ACRD also collaborated with Technology Crops International to develop an analytical method to facilitate regulatory approval of the company's Ahiflower Oil™, which is promoted as one of the richest natural plant sources of omega-3 fatty acids.
- Together with industrial collaborators, Canadian Natural Resources Limited and Pond Biofuels, ACRD completed designing a pilot facility to demonstrate the commercial viability of harnessing algae to convert industrial emissions into biomass for transformation into valuable products such as biofuel, fertilizer and livestock feed while reducing carbon dioxide in the atmosphere. Plans were made to begin constructing a 25,000 liter facility at an Ontario industrial site in 2015-16, and to use the data and lessons learned from its operation to improve designs for a larger pre-commercial facility planned for construction in Alberta in 2016-17.
- With support from the Genomics R&D Initiative[xiv] (GRDI), the Canadian Wheat Alliance[xv], of which NRC is a founding member, forged an agreement with two leading plant breeding companies to collaborate on improving wheat breeding efficiency, with breeding cycles to be reduced from the conventional four or five years to as little as one year.
- The sub-program launched a Bio-based Specialty Chemicals research initiative designed to develop innovative technologies to produce high-value specialty chemicals from biomass, putting in place capabilities such as bioreactors and bioprocessing technologies, fibre technologies, metabolic engineering and microbial strain development, process integration and scale-up. These capabilities were established to help Canadian firms bridge technical gaps, lower R&D costs, and reach commercial activity 15-20% faster while capturing a greater share of the global market. In 2014, this Canadian industry was valued at $300M with the global industry expected to reach $13B by 2021.

Additional information is available on the sub-program's website[xvi].

[8] Other" revenue includes revenue derived from one or more of: sales of goods (certified reference materials), lease and use of property and equipment, and grants and contributions.

Sub-Program 1.1.7: Medical Devices (MD)

This sub-program applies expertise in biochips, nano-materials, micro-devices, in vitro diagnostics, imaging, optical bio-photonics, medical simulation, and radio-frequency engineering and electronics to develop and advance technologies for enhancing the prosperity of the medical device industry as it strives to respond to increasing demands for equipment and supplies that are faster, more accurate, more informative, more affordable and less invasive. The industry is important for its growing contribution to Canada's GDP and its contribution to effective and efficient health care. Results are achieved through provision of industry-driven technical services and multi-disciplinary collaborative research.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
10,678,459	11,289,661	611,202

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
65.0	69.6	4.6

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements in medical devices for the marketplace	Client/stakeholder financial investment in technology development, $ millions	$3.5M annually by March 2015	$2.2M
	Licensing and royalty revenue from NRC clients, $ millions	$0.06M annually by March 2015	$0.36M

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $2.2M in financial investments during 2014-15 towards the advancement of technologies ($0.3M technical services, $1.4M collaborative research, $0.4M licensing and royalties, and $0.1M other[9]).

Highlights from 2014-15 include:

- Technology developed by the sub-program was adopted into a new smart imaging system from Calgary's Kent Imaging that quickly gauges wound health without any invasive procedures or need to touch affected tissue, allowing clinicians and healthcare practitioners to provide a next-generation level of care. The collaboration with Kent Imaging represents a cumulative investment by the company of over $2M. It has enabled the Canadian SME to grow while developing an innovative product that addresses an important clinical need.

- Based on promising commercial potential, AmorChem, a Montreal venture capital fund, invested in the refinement and validation of a porous titanium implant that was co-developed by NRC-Medical Devices with McGill University Health Centre for fixation of a common wrist fracture of the scaphoid bone, which often does not heal properly using conventional techniques involving solid screws. It is estimated such fractures comprise 245,000 cases annually in Canada, US and Europe. Based on positive test results, AmorChem began seeking regulatory approval while pursuing commercialization opportunities. NRC has committed its technical expertise to ensure successful transfer of the technology.

- Using NRC technology and infrastructure, Quebec's Handyem Inc. developed a portable analytical instrument for performing analyses that, until now, could only be carried out in centralized laboratories. The instrument counts and sorts cells, and detects biomarkers important for disease identification. The instrument can be brought as close to the sample as needed in the field and used in places never before possible. This has opened applications for "on-site" use in clinical and emerging areas including pharmaceutical, agriculture, veterinary or food-water applications. The instrument features components that were designed and fabricated using the sub-program's capabilities in micro-nanofabrication and numerical simulation. The innovative technology has enabled the company to grow from 4 to 22 employees.

- The sub-program collaborated with industry, public agencies, and universities to develop a more rapid method of detecting *E. Coli* bacteria in food. Consequently, life-threatening contamination can be detected in as little as 8 hours compared to the conventional 4 days.

Additional information is available on the sub-program's website[xvii].

[9] Other" revenue includes revenue derived from one or more of: sales of goods, lease and use of property and equipment, and grants and contributions.

Sub-Program 1.1.8: Human Health Therapeutics (HHT)

In collaboration with industry, this sub-program develops vaccines and biologics for enhancing the prosperity of the Canadian bio-therapeutics industry, and to provide more effective treatments to Canadians. Activities include developing biologic materials for treating and preventing infectious and chronic diseases, and technologies to deliver therapeutics from circulation in the blood to the central nervous system. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services for transferring or advancing technologies into deployed solutions and improved practices for the marketplace.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
42,092,378	46,374,942	4,282,564

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
278.0	290.3	12.3

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Improved and more affordable vaccines and biologics for the marketplace	Client/stakeholder financial investment in technology development, $ millions	$11.3M annually by March 2015	$14.8M
	Licensing and royalty revenue from NRC clients, $ millions	$1.60M annually by March 2015	$2.51M

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $14.8M in financial investments during 2014-15 towards the advancement of technologies, mainly from $12.2M invested in collaborative research. In addition, client investments included $2.5M for licenses and royalties for exploiting a solid foundation of platform technologies built by HHT over the past few years. This is a significant achievement as the recent expiration of HHT's patent for the *Meningitis-C* vaccine had left a $3.5M gap in royalty receipts.

A recent evaluation[xviii] confirmed that HHT had a significant positive impact on the technological capabilities and market performance of its industrial clients. With HHT helping to de-risk, add value and accelerate development of their products and technologies, clients estimated that they attracted further investment ($46M) and increased their market valuations (by $145M) attributable to their interactions with HHT.

In addition, independent management consultants reviewed HHT's research initiative that develops biologic therapies for treating and preventing diseases. It concluded that the initiative's business model remained sound, that it was effectively managed, and addressed a viable unmet marketing opportunity.

HHT's impact is further illustrated by the following accomplishments in 2014-15:

- HHT collaborated with Lilly Creek Vaccines and AMRIC to develop a vaccine that prevents gastritis, ulcers, and gastric cancer, particularly important for northern communities where infection rates greatly surpass the national average.
- NRC collaborator, NPS Pharmaceuticals, received regulatory approval to commercialize the first parathyroid hormone for hypoparathyroidism affecting calcium in blood and bone. The biotechnology production process was developed with support from HHT.
- Alethia Biotherapeutics prepared for clinical trials of a monoclonal antibody, co-developed with HHT with support from GRDI[xiv], for treating advanced solid tumours.
- A HHT collaborator received approval to progress its Group A *Streptococcus* vaccine to clinical trial. HHT had developed the product processes for components of the vaccine.
- HHT began developing new cell lines and new production processes, with support from GRDI[xiv], to address an urgent request from the Public Health Agency of Canada (PHAC) for assistance in producing investigational antibodies to counter the deadly *Ebola* virus.
- Two SME clients (British Columbia's biOasis Technologies Inc. and Ontario's KalGene Pharmaceuticals Inc.) received funding to develop innovations against brain diseases with HHT.

Additional information is available on the sub-program's website[xix].

Sub-Program 1.1.9: Information and Communication Technologies (ICT)

In support of Canada's digital economy, this sub-program applies leading-edge expertise in software development, semiconducting materials and photonic device design and fabrication to design, validate, demonstrate and deliver both physical and software solutions that lead to new market opportunities for industries in Canada's information and communication technology (ICT) sector that seek to profit from an explosive growth of data and from escalating needs for greater connectivity and for revolutionary ways to use computers to make decisions, synthesize information, and discover new knowledge. This is important for increasing Canada's global share of the growing ICT market. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services in state-of-the-art facilities for transferring or advancing technologies into deployed solutions and improved practices for the marketplace. This includes custom manufacturing of novel components for innovative photonic, electronic, and opto-electronic devices.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
37,529,288	40,459,204	2,929,916

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
186.0	194.1	8.1

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancements of process and product technologies for the information and communications technology sectors	Client/stakeholder financial investment in technology development, $ millions	$8.3M annually by March 2015	$9.7M
	Licensing and royalty revenue from NRC clients, $ millions	$0.95M annually by March 2015	$0.32M

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $9.7M in financial investments during 2014-15 towards the advancement of technologies ($6.6M technical services, $2.8M collaborative research, $0.3M licensing and royalties). Furthermore, 31 new agreements were signed with Canadian and global clients for over $8M to advance technologies for image processing and simulation, personalized training and e-learning as well as to improve Canada's position in the global supply chain for telecom and datacom networks. ICT and the Canadian Microelectronics Centre forged an agreement to produce prototypes of new devices in photonics, aerospace and radar communications, and printable electronics.

Highlights from 2014-15 include:

- Assisted Quebec-based TeraXion to develop an optical transmitter that sends information across the global optical fibre communications network at higher speeds than previously possible. This established TeraXion as a major player in the global telecommunications market while addressing increasing demands of Internet and mobile communications users.
- Advanced ICT's sentiment/emotion analysis software to the commercialization stage for application in the security sector.
- Collaborated with industry and security agencies to deliver state-of-the-art 3-D image processing and simulation capabilities with possible applications for brain imaging and surgery simulation.
- Renewed annual financial commitments with 10 members of the Printable Electronics consortium in a joint effort to advance Canada's printable electronic industry. Impact is showcased through Raymor Industries, a licensee of a technology developed with ICT, receiving the award for best new material at IDTechEX USA 2014, the world's largest printed electronics conference and trade show. The award-winning product, a functional semi-conductor ink derived from carbon nanotubes, is the highest purity semiconducting nanotube ink (99.9% pure) on the market today.
- Released the first version of a software platform for personalized training and e-learning, seamlessly integrating resources from multiple formats. This platform has already attracted over 100 subscribers. Work started on developing software that will accelerate subsequent releases and power the next generation of NRC-IRAP Concierge[xx].

Additional information is available on the sub-program's website[xxi].

Sub-Program 1.1.10: Security and Disruptive Technologies (SDT)

This sub-program builds and validates emerging technology platforms (such as nanotechnology, quantum technologies and the convergence of nano-, bio- and information technologies) that can be applied in a range of industries to sustain Canada's industrial competitiveness by opening new markets and value networks for Canadian industries in tomorrow's economy. Efforts focus on applications for addressing national security challenges because security and defence innovation players are amongst the earliest adopters of such technologies from which broader commercial adaptations ultimately evolve, replacing existing technologies. Results are achieved through multi-disciplinary collaborative research and development services in addition to specialized technical services in state-of-the-art facilities for ultimately introducing disruptive and transformational technology solutions into practice and the marketplace.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
28,315,928	28,536,528	220,598

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
171.0	161.4	-9.6

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Advancement of process and product technologies in security and other industry sectors	Client/stakeholder financial investment in technology development, $ millions	$3.5M annually by March 2015	$3.4M
	Licensing and royalty revenue from NRC clients, $ millions	$0.12M annually by March 2015	$0.08M

Performance Analysis and Lessons Learned

Client and stakeholder engagement is evidenced by a total of $3.4M in financial investments during 2014-15 towards the advancement of technologies ($1.2M technical services, $2.1M collaborative research, $0.1M licensing and royalties).

Highlights from 2014-15 include:

- Demonstrated the world's first pilot-scale production of boron nitride nanotubes (BNNTs), using specialized equipment from Canada's Tekna Plasma Systems, achieving a production rate 100 times faster than anywhere in the world. BNNTs, previously available only in extremely small batches, are exceptionally strong and lightweight materials suitable for next-generation armour and other advanced manufacturing applications. SDT's breakthrough makes Canada the leading producer of this unique material in terms of price, volume and quality.
- Strengthened Canada's position as a world leader in optical and laser technologies by developing manufacturing methods enabling temperature sensors that operate in extreme environments where conventional methods fail. Targeting the energy sector, sensors were installed into Natural Resources Canada's pilot gasification plant to monitor reactor temperature, demonstrating faster and more accurate results compared to all conventional methods.
- Developed the world's first commercial application of molecular junction technology, building functional electronic components using single molecules as building blocks. This revolutionary technique enables sounds not possible through conventional electronic components. The prototype, licensed to Alberta's Dr. Scientist Sounds, opens opportunities in the $2B guitar pedal world market. This breakthrough application, which enables advances in audio processing and sensing, places Canada at the forefront of the emerging molecular electronics field. Work continued with clients to understand the impact of nanomaterials on their products and to identify methods that could potentially scale this to industry-level production.
- Collaboration with the University of Alberta also led to the creation of a new company, Qlit, to develop and commercialize a fundamentally new approach to next-generation computers using quantum physics to break barriers in high computer speed and ultralow power consumption. The National Institute of Nanotechnology's (NINT) role was to take a laboratory scale concept and demonstrate the possibility of scaling up a manufacturing process – a critical milestone to attract investors. NINT also continued to advance the development of standards and measurement tools for characterizing cellulose nanocrystals in direct support of applications and the responsible deployment of nanotechnologies.

Additional information is available on the sub-program's website[xxii].

Program 1.2: Industrial Research Assistance Program (IRAP)

The program contributes to the growth and prosperity of Canadian small and medium sized enterprises (SMEs) by stimulating innovation, adoption and/or commercialization of technology-based products, services, or processes in Canada. This is done through: 1) technical and related business advice and networking facilitated by a cross-Canada network of field professional staff; 2) cost-shared merit-based contributions; and 3) contributions supporting employment of post-secondary graduates. This program uses funding from the following transfer payments: IRAP Contributions to Firms; IRAP Contributions to Youth Employment Strategy; Contributions to Organizations; and Contributions for the Digital Technology Adoption Pilot Program (DTAPP).

Budgetary Financial Resources (dollars)

2014–15 Main Estimates	2014–15 Planned Spending	2014–15 Total Authorities Available for Use	2014–15 Actual Spending (authorities used)	2014–15 Difference (actual minus planned)
260,499,279	270,670,144	301,733,723	271,824,267	1,154,123

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
452.0	356.9	-45.1

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Innovative businesses grow in Canada	SME jobs supported	4000 annually by March 2015	6240 supported through contributions.
	SMEs served (through funding)	2200 annually by March 2015	2564 SMEs funded through the Contributions to Firms transfer payment program.
	SME client feedback on growth: jobs, revenues, net operating profit	Under Development [1]	62% of IRAP clients reported growth in jobs, revenues, or profit as a result of IRAP support.

[1] The indicator lags by one year due to survey methodology. As this is a new performance indicator, its implementation will be reviewed and refined during 2015-16, and a performance target will be established.

Performance Analysis and Lessons Learned

IRAP generally exceeded its annual targets for 2014-15. A total of 2564 firms were funded through Contributions, supporting 9240 jobs including 1595 for recent graduates. A total of 885 SMEs responded to post-project surveys. Overall, they indicated that their full-time workforce grew by 18%, and their revenues increased by 17% due to IRAP support.

The 2013-14 launch of the Business Innovation Access Program (BIAP) expanded IRAP's ability to help SMEs obtain direct access to business and technical services from Canada's learning institutions, and from other publicly-funded research organizations, in order to commercialize their products or services faster. During its first full year of operation, 392 BIAP projects were approved for funding.

NRC-IRAP Concierge continued to grow as a single access point to information on funding, expertise, and facilities for SMEs seeking to grow through innovation. Expert innovation advisors engaged with SMEs to provide customized guidance and direct referrals to the most relevant resources available from partner organizations across the country. During 2014-15, NRC-IRAP Concierge assisted 1,378 clients, surpassing its operational target by 20%.

IRAP negotiated and signed Contribution Agreements with the 15 candidates advancing in the Canadian Accelerator and Business Incubator Program (CAIP). These agreements establish a critical mass of outstanding business incubators and accelerators that can develop innovative, high-growth SMEs over five years.

IRAP also delivered the Canadian HIV Technology Development Program (CHTD) on behalf of Industry Canada. A total of 17 CHTD projects were approved in 2014-15 to develop new and innovative technologies against the immunodeficiency disease.

The following are examples of impacts during 2014-15 following advice and transfer payments provided by NRC-IRAP:

- St. John's Vorelle more than tripled sales of its enterprise fraud detection and anti-money laundering software. It also attracted over 1000 client financial institutions, becoming a leader in the North American market.
- Montreal-based Kinova Inc. developed an innovative robotic arm accessory for wheelchairs that greatly increases autonomy. Kinova exported to over 25 countries, with clients including Google, iRobot, NASA and Microsoft.
- Kingston's MetalCraft Marine grew to a 140-employee global leader in development of high-performance aluminum boats.
- Vancouver's Saltworks Technologies, which automated and improved its ion-exchange membrane technology for purifying industrial wastewater, grew to over 50 employees and received over 40 patents plus annual revenue in the millions.
- Whitehorse-based Icefield Tools Corporation developed the world's most precise bore-hole survey tool that allows fast, cost-effective drilling for oil, gas, and minerals. Consequently, the company thrived globally despite depressed resource-extraction markets.

Additional information is available on the program's website[xxii].

Strategic Outcome 2: R&D infrastructure for an innovative and knowledge-based economy

Program 2.1: Science Infrastructure and Measurement (SIM)

This program manages national science facilities and infrastructure critical to research, development and innovation by Canadian scientific and technological communities. This includes operating and advancing Canada's astronomical observatories. It also fosters development and maintenance of Canada's metrological infrastructure system that provides reference and traceability access to reliable measurements that are traceable to recognized national standards maintained by the program. The program helps clients make the most of this infrastructure by facilitating access to a wide range of Canadian and international user communities and by participating in networks. In addition, the program provides ownership of the CNRC-NRC cell-access research facility. This program was funding from the following transfer payment: CNRC-NRC (Canada's National Laboratory for Particle and Nuclear Physics).

Budgetary Financial Resources [1] (dollars)

2016-17 Main Estimates	2016-17 Planned Spending	2016-17 Total Authorities Available for Use	2016-17 Actual Spending (authorities used)	2016-17 Difference (actual minus planned)
108,726,529	101,777,277	117,794,762	108,451,365	6,674,088

Human Resources (FTEs)

2016-17 Planned	2016-17 Actual	2016-17 Difference (actual minus planned)
258.9	269.9	10.9

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
National science infrastructure and measurement standards services are valued by user communities	Client user satisfaction with CNRC services and facilities	90% annually by March 2019	An evaluation of the MSS sub-program was started in 2016-17, including case studies and interviews with clients and stakeholders. The exercise indicated that clients have a high level of satisfaction overall, indicating progress towards the target. This is supported by the sub-program continuing to exceed its performance targets, including clients served and the number of publications.[2]

[1] In the 2016-17 RPP, spending and FTEs for common services in support of sub-programs and SIM-MP were excluded from sub-programs totals. However, in this document (DPR), spending and FTEs for common services in support of sub-programs were included in sub-program totals. As such, this change in methodology increases the spending and FTEs numbers for sub-programs in this document (DPR).

Performance Analysis and Lessons Learned

The Program provided Canadians with access to world-class research infrastructure, including leading-edge observatories and one of the world's largest accessible collections of astronomical data. The relevance and demand for telescope access is demonstrated by the high subscription rates for Canada's international telescopes.

SI&M also provided traceable measurements that define the national measurement standards in line with international requirements, thus enabling Canadian industry's entry to international markets. Providing industry with access to reliable measurement materials enables them to respond to changing regulatory and standardization frameworks. In 2014-15, NRC's first biotoxin metrology calibration and measurement capabilities received international recognition. This recognition supported the ability of testing laboratories to demonstrate their competences and respond to the demand for chemical analytical methods to replace animal bioassays for toxin monitoring.

In 2014-15, the MSS sub-program underwent an evaluation, which included case studies and interviews with clients and stakeholders. The exercise's preliminary results indicated that clients have a high level of satisfaction overall, indicating progress towards the targeted objective. This is supported by the sub-program continuing to exceed its performance targets, including having served 789 clients and 2124 publications by telescope users.

The Program provided $45M in transfer payments to TRIUMF, a joint venture by a consortium of Canadian universities, which functions as Canada's national laboratory for research in subatomic physics. The funding was used for leading-edge academic and applied research including advancing Canada's abilities to generate medical isotopes. Construction of Phase I of TRIUMF's Advanced Rare IsotopE Laboratory (ARIEL) was completed in 2014-15 thus allowing work to continue to advance towards the full commissioning of ARIEL and the expansion of Canada's capabilities to produce and study isotopes for physics and medicine.

Sub-Program 2.1.1: National Science Infrastructure (NSI)

This sub-program manages Canada's astronomical observatories as mandated in the National Research Council Act, and it compiles and disseminates astronomical data while leveraging access to international observatories for Canadian researchers in astrophysics. This sub-program uses funding from the following transfer payment: Contributions to the International Astronomical Observatories Program.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
31,721,875	35,259,460	3,537,585

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
116.0	116.6	0.6

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Canadian scientists have access to astronomical observatories and data	User access and downloads of astronomy data	4000 annually by March 2015	8300
	Scientific publications by telescope users	300 annually by March 2015	451

Performance Analysis and Lessons Learned

NRC's Canadian Astronomy Data Centre (CADC) provides to the astronomy community real-time access to data from observatories in which Canada has an interest as well as to other astronomy data made accessible by providers around the world. During 2014, NSI's Canadian Astronomy Data Centre (CADC) delivered over 38 million individual astronomy files, comprising 1080 terabytes of data, to roughly 8300 professional astronomers. CADC data enabled 451 scientific publications by users of the service. CADC also successfully applied innovative cloud-computing to enable the full exploitation by users of massive data sets produced by astronomical surveys.
Highlights from 2014-15 include:

- Canada announced its participation in the Thirty Meter Telescope[xxiv] (TMT), an international collaboration to construct one of the most advanced optical telescope on Earth, extending astronomers' vision to the most distant reaches of the universe. In collaboration with Canadian industry, NSI continued to work on Adaptive Optics (an essential technology of the TMT and one of Canada's contributions to the telescope) to overcome the blurring effect of the Earth's atmosphere. Canada's participation and contributions ensure that Canadian astronomers will have access to this leading-edge telescope for new discoveries profoundly advancing the understanding of the cosmos.

- NSI developed a composite reflector Dish Verification Antenna which has 30% better sensitivity than other technology currently available. Licensed to Ontario's General Dynamics, this technology is the first application of NRC's potentially disruptive composite technology in a commercial production environment.

- With Australian counterparts, NSI was contracted to provide a new instrument for the international Gemini Observatory to improve imaging in the blue end of the visible spectrum. The technology passed its preliminary design review, allowing it to advance to the critical design phase.

- NSI's leadership in astronomy is illustrated by its selection to lead the international consortium that is designing advanced signal processing capabilities combining data from individual telescopes to produce radio images for the Square Kilometre Array[xxv], an international radio telescope project currently at the design phase.

- NSI signed $1.7M in contracts with industry partners to support astronomy technology activities such as engineering design and prototype fabrication including work on optical, electronics, and signal-processing technologies.

Additional information is available on the sub-program's website[xxvi] and in the Supplementary Tables[xxvii] for the Transfer Payment Program on international telescopes.

Sub-Program 2.1.2: Measurement Science and Standards (MSS)

As mandated under the National Research Council Act and also the Weights and Measures Act, this sub-program investigates and determines standards and methods of measurement for Canada's national measurement system. This national metrological system is critical for underpinning trade and commerce in the global economy. The sub-program supports international metrological treaties and arrangements to establish and maintain foreign recognition and acceptance of Canada's standards and measures that are critical for participation in multi-lateral and free-trade agreements. The sub-program provides a wide variety of calibration and measurement services that underpin the accuracy of millions of measurements conducted annually in public and private sector testing and calibration laboratories. In addition, the sub-program provides expert assessments and formal recognition of the measurement capabilities of industrial calibration laboratories. This is important for providing Canada's trading partners confidence in the reliability of Canadian industries' measurements and test certifications of compliance to regulatory and product standards that govern trade. The sub-program also develops measurement standards for emerging technologies that open new global market opportunities for Canadian industries.

Budgetary Financial Resources (dollars)

2014–15 Planned Spending	2014–15 Actual Spending	2014–15 Difference (actual minus planned)
23,908,500	26,192,123	2,283,623

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
133.0	153.3	20.3

Performance Results

Expected Results	Performance Indicators	Targets	Actual Results
Internationally-recognized national system of measurement that meets Canada's evolving needs.	Clients served	725 annually by March 2015	789
	International recognition of calibration and measurement capabilities	600 annually by March 2015	623 calibration and measurement capabilities recognized by formal international agreement
	Scientific and other publications in metrology	1500 annually by March 2015	2124

Performance Analysis and Lessons Learned

MSS served 789 clients while 623 of its calibration and measurement capabilities were formally recognized internationally and included in the Key Comparisons Database of the International Bureau of Weights and Measures (BIPM). BIPM works to ensure and promote the global comparability of measurements, including providing a coherent international system of units for scientific discovery and innovation, industrial manufacturing and international trade and sustaining the quality of life and the global environment. MSS contributed 70 scientific papers to the metrology literature plus 2054 calibration and other reports to clients in contribution to Canada's knowledge-based economy.

The beginning of the long dash indicates exactly...

November 2014 marked the 75th anniversary of Canada's longest-running radio program, the NRC Time Signal, broadcasted by the CBC and maintained by MSS. Canadians depend on the Time Signal as the standard by which to set their clocks.

Highlights from 2014-15 include:

- MSS assisted the Ottawa Hospital in improving the accuracy of radiation therapy dosage, and played a leading role in improving protocols to determine radiation doses for cancer treatment across North America.
- MSS strengthened the national measurement system by introducing 10 new measurement services, including five in electric power measurement, to meet the needs of manufacturing and precision instrument users for traceable measurements critical for achieving the highest possible levels of measurement quality and productivity. The new services have attracted clients' interest for their annual calibration needs, with return customers in the transportation sector.
- NRC's first biotoxin metrology capabilities were formally accepted internationally. Developed in response to industry demand, this acceptance supports the credibility of Canada's measurement system and extends industry's access to internationally-recognized certification.
- MSS undertook a pioneer project to standardize cellulose nanocrystals used in next-generation high technology products including possible applications to improve fluid handling in the oil and gas industry and strengthening composites for the materials sector. Results are expected to facilitate access to international markets.
- MSS researchers were appointed to several international standards-development committees in transportation, supporting the interests of Canadian industry in the global automotive and aviation markets.
- The certification of laboratories by MSS' Calibration Laboratory Assessment Service[xxviii] received US nuclear regulatory recognition, enabling Canadian companies access to the US nuclear industry's testing and calibration market.

Additional information is available on the sub-program's website[xxix].

Program: Internal Services

Internal Services are groups of related activities and resources that are administered to support the needs of programs and other corporate obligations of an organization. These groups are: Management and Oversight Services; Communications Services; Legal Services; Human Resources Management Services; Financial Management Services; Information Management Services; Information Technology Services; Real Property Services; Material Services; Acquisition Services; and Other Administrative Services. Internal Services include only those activities and resources that apply across an organization and not to those provided specifically to a program.

Budgetary Financial Resources (dollars)

2014–15 Main Estimates	2014–15 Planned Spending	2014–15 Total Authorities Available for Use	2014–15 Actual Spending (authorities used)	2014–15 Difference (actual minus planned)
203,472,708	206,591,964	288,646,700	232,498,650	25,906,686

Human Resources (FTEs)

2014–15 Planned	2014–15 Actual	2014–15 Difference (actual minus planned)
928.0	950.7	22.7

Performance Analysis and Lessons Learned

The *Secure NRC* initiative was launched to enhance the culture of security while rebuilding new secure IT infrastructure and begin migrating corporate applications and research functions to a new environment. Through this high priority project, NRC began revising its security strategy and framework and increasing the security group's capacity. It also reviewed and updated its Departmental Security Plan (DSP), which includes a prioritized set of 12 key action items that became part of a renewed NRC security protocol. New end-user devices (e.g., laptops and printers) with enhanced security features were deployed to all NRC employees to access the corporate network and applications. Two major corporate applications (for managing IRAP contributions and for managing business operations) were migrated to the new secure IT environment. Plans were developed to bring NRC to full productivity by December 2015 within its existing environment, and to migrate the remaining corporate applications and research functions to the new IT environment thereafter. NRC remained operational to provide service to its clients through a combination of the interim and the new secure IT environments. The un-planned costs of the cyber intrusion represented $23.3M of the 2014-15 difference between actual and planned expenditures.

Common Services Streamlining – NRC completed the design of end-to-end priority processes in areas of finance, human resources, administrative and property management, and information technology and security. The streamlining project was suspended to permit reallocation of

resources to the *Secure NRC* initiative following the cyber-intrusion and is expected to resume in June 2015.

Program and Project Management – Through its interim secure environment, NRC managed all its projects using its business system with linkage to detailed program plans reflecting project scope, cost, schedule, market analysis, and forecasts of economic benefits. Three independent midterm reviews of NRC research initiatives were undertaken in areas of biologics, advanced photonic components, and industrial biomaterials. Reviews of the remaining research initiatives are scheduled for the 2015-17 period on a 3-year cycle to assess the continued validity of the NRC research initiatives.

Communications – A new service delivery model supported NRC's client-focussed business objectives. Plans for migrating to a shared information portal were delayed by the cyber-intrusion response, but were set to resume in 2015-16.

Human Resources - Various learning events were held, including labour relations workshops, advanced the development and engagement of supervisors. The majority of participants indicated that the learning has equipped them to become more successful in their roles. NRC began implementing a revitalized rewards and recognition initiative to continue to foster a culture of recognition. In the context of classification renewal, management positions were converted to a more modern evaluation system, and generic job descriptions were developed for technical staff using a participatory approach.

Business Support – Over 100 cross-functional strategic intelligence reports were prepared by technical business analysts and information specialists to help NRC identify areas offering the potential for NRC to have significant impacts. These reports provided actionable intelligence on new or potential clients and markets, as well as on the potential of existing and new technologies.

Section III: Supplementary Information

Financial Statements Highlights

National Research Council Canada
Condensed Consolidated Statement of Operations and Departmental Net Financial Position
(audited)
For the Year Ended March 31, 2015
(dollars)

	2014–15 Planned Results	2014–15 Actual	2013–14 Actual	Difference (2014–15 actual minus 2014–15 planned)	Difference (2014–15 actual minus 2013–14 actual)
Total expenses	998,383,000	965,868,000	933,517,000	(32,515,000)	32,351,000
Total revenues	200,058,000	146,723,000	156,349,000	(53,335,000)	(9,626,000)
Net cost of operations before government funding and transfers	798,325,000	819,145,000	777,168,000	20,820,000	41,977,000
Departmental net financial position	569,573,000	600,170,000	574,479,000	30,597,000	25,691,000

Expenses by Type (2014-15)

Type	Percent of total expenses
Salaries and employee benefits	45
Grants and contributions	27
Utilities, materials, and supplies	8
Professional and special services	7
Amortization	6
Other	6

NRC incurred total expenses of $965.9M in 2014-2015, an increase from the $933.5M spent in 2013-2014. Salaries and employee benefits ($432M) and grants and contributions ($263.8M), represented 72% of total expenses. The $32.4M increase in expenses was primarily due to an increase in salaries and employee benefits ($27.3M) and professional services ($18.3M) offset by a decrease of grants and contributions ($14.6M). The increase in salaries and employee benefits is primarily the result of a severance benefits expense of $12.9M caused by a change in actuarial assumptions used to calculate the liability, and the general economic increase in salary rates. The increase in professional fees was primarily due to a $12.7M expense for the Secure NRC project. The decrease in grants and contributions expenses is mainly due to the end of the Digital Technologies Adoption Pilot Program (DTAPP) ($34.8M) and a decrease in contributions to firms and organizations ($13.3M) offset by the creation of the Business Innovation Access Program (BIAP) ($8.2M) and the Canada Accelerator Incubator Program (CAIP) ($10.6M). Most other expense categories

appearing in the financial statements were stable in comparison to 2013-2014. The planned expenses, as reported in NRC's Future Oriented Financial Statements in the 2014-2015 Report on Plans and Priorities (RPP), were $998.4M. The variance between planned and actual results was primarily due to lower operating expenses such as utilities, materials and supplies, amortization, and transportation and communication, which ensued from less business with external clients than forecasted due to the cyber intrusion.

NRC generates revenue which can be reinvested in operations. NRC earned total revenues of $146.7M in 2014-2015, a decrease from $156.3M in 2013-2014. NRC's major revenue components were Research Services ($46.2M) and Technical Services ($75M), representing 82% of revenues. The planned revenues, as reported in NRC's Future Oriented Financial Statements in the 2014-2015 RPP were $200.1M. The variance between planned and actual amounts of revenues is due to a disruption to NRC's business environment, as a result of the cyber-intrusion on its IT infrastructure.

Revenue by Type (2014-15)

Type	Percent of total revenues
Technical Services	51
Research Services	31
Intellectual property, royalties, and fees	5
Rentals	4
Sales of goods and information products	3
Other	6

National Research Council Canada
Condensed Consolidated Statement of Financial Position (audited)
As at March 31, 2015
(dollars)

	2014–15	2013–14	Difference (2014–15 minus 2013–14)
Total net financial assets	359,591,000	307,097,000	52,494,000
Total liabilities	291,013,000	272,569,000	18,444,000
Departmental net financial assets	68,578,000	34,528,000	34,050,000
Total non-financial assets	531,592,000	539,951,000	(8,359,000)
Departmental net financial position	600,170,000	574,479,000	25,691,000

NRC's consolidated net financial assets totalled $359.6M as at March 31, 2015, an increase of $52.5M from the March 31, 2014 balance of $307.1M. The balance is made up of the Due from the Consolidated Revenue Fund (CRF), accounts receivable, inventory for resale, and cash and investments. The increase was primarily due to a $44.3M increase of the Due from the CRF and an increase in accounts receivable of $6.7M.

Net Financial Assets as at March 31, 2015

Type	Percent of total net financial assets
Due from the Consolidated Revenue Fund	88
Accounts receivable and advances	10
Inventory for resale	1
Cash and investments	1

Liabilities as at March 31, 2015

Type	Percent of total liabilities
Accounts payable and accrued liabilities	61
Vacation pay and compensatory leave	10
Lease inducements	13
Deferred revenue	3
Employee Future Benefits	13

NRC's liabilities consist of accounts payable and accrued liabilities, vacation and compensatory leave, lease inducements, deferred revenue and employee future benefits. The balance as at March 31, 2015 of $291M represents an $18.4M increase from the March 31, 2014 balance of $272.6M. The increase was primarily due to higher accounts payable and accrued liabilities payable to external parties at year-end and an increase in grants and contributions payable in majority due to claims in relation to the new Canadian Accelerator and Incubator Program (CAIP). This was offset by a decrease in the employee future benefits liability, as a result of the ratification of a number of collective agreement settlements, which are no longer eligible to accumulate severance benefits.

The overall increase in consolidated net financial assets contributed to NRC having a departmental net surplus position as at March 31, 2015, a measure of the organization's ability to provide future resources to finance future operations. NRC's strong financial position is also reflected in its Departmental Net Financial Position at March 31, 2015, which was improved by $25.7M over the previous year to $600M.

Financial Statements

NRC's complete financial statements are published on NRC's website[xxv].

Supplementary Information Tables

The Supplementary Information Tables listed in the *2014-15 Departmental Performance Report* [xxvi] can be found on the NRC's website.

- Departmental Sustainable Development Strategy;
- Details on Transfer Payment Programs;
- Horizontal Initiatives;
- Internal Audits and Evaluations;

- *Response to Parliamentary Committees and External Audits*, and
- *User Fees Reporting*.

Tax Expenditures and Evaluations

The tax system can be used to achieve public policy objectives through the application of special measures such as low tax rates, exemptions, deductions, deferrals and credits. The Department of Finance Canada publishes cost estimates and projections for these measures annually in the *Tax Expenditures and Evaluations*[xxiii] publication. The tax measures presented in the *Tax Expenditures and Evaluations* publication are the sole responsibility of the Minister of Finance.

Section IV: Organizational Contact Information

Questions and requests for information may be directed to:

National Research Council of Canada
NRC Communications
1200 Montreal Road, Bldg. M-59
Ottawa, Ontario, Canada K1A 0R6
Phone: (613) 993-9101 or toll-free 1-877-NRC-CNRC (1-877-672-2672)
Fax: (613) 952-9907
TTY number: (613) 949-3042
E-mail: info@nrc-cnrc.gc.ca

Appendix: Definitions

Appropriation: *Any authority of Parliament to pay money out of the Consolidated Revenue Fund.*

Budgetary expenditures: Include operating and capital expenditures, transfer payments to other levels of government, organizations or individuals, and payments to Crown corporations.

Departmental Performance Reports: Reports on an appropriated organization's actual accomplishments against the plans, priorities and expected results set out in the corresponding Reports on Plans and Priorities. These reports are tabled in Parliament in the fall.

Full-time equivalent: *Is a measure of the extent to which an employee represents a full person-year charge against a departmental budget. Full-time equivalents are calculated as a ratio of assigned hours of work to scheduled hours of work. Scheduled hours of work are set out in collective agreements.*

Government of Canada outcomes: A set of 16 high-level objectives defined for the government as a whole, grouped in three spending areas[2] : economic affairs, social affairs, international affairs and government affairs.

Management, Resources and Results Structure: A comprehensive framework that consists of an organization's inventory of programs, resources, results, performance indicators and governance information. Programs and results are depicted in their hierarchical relationship to each other and to the Strategic Outcome(s) to which they contribute. The Management, Resources and Results Structure is developed from the Program Alignment Architecture.

Non-budgetary expenditures: Include net outlays and receipts related to loans, investments and advances, which change the composition of the financial assets of the Government of Canada.

Performance: What an organization did with its resources to achieve its results, how well those results compare to what the organization intended to achieve and how well lessons learned have been identified.

Performance indicator: *A qualitative or quantitative means of measuring an output or outcome, with the intention of gauging the performance of an organization, program, policy or initiative respecting expected results.*

Performance reporting: *The process of communicating evidence-based performance information. Performance reporting supports decision making, accountability and transparency.*

Planned spending: For Reports on Plans and Priorities (RPPs) and Departmental Performance Reports (DPRs), planned spending refers to those amounts that receive Treasury Board approval by February 1. Therefore, planned spending may include amounts incremental to planned expenditures presented in the Main Estimates.

A department is expected to be aware of the authorities that it has sought and received. The determination of planned spending is a departmental responsibility, and departments must be able to defend the expenditure and accrual numbers presented in their RPPs and DPRs.

Plans: The articulation of strategic choices, which provides information on how an organization intends to achieve its priorities and associated results. Generally a plan will explain the logic behind the strategies chosen and tend to focus on actions that lead up to the expected result.

Priorities: Plans or projects that an organization has chosen to focus and report on during the planning period. Priorities represent the things that are most important or what must be done first to support the achievement of the desired Strategic Outcome(s).

Program: A group of related resource inputs and activities that are managed to meet specific needs and to achieve intended results and that are treated as a budgetary unit.

Program Alignment Architecture: A structured inventory of an organization's programs depicting the hierarchical relationship between programs and the Strategic Outcome(s) to which they contribute.

Report on Plans and Priorities: Provides information on the plans and expected performance of appropriated organizations over a three-year period. These reports are tabled in Parliament each spring.

Results: An external consequence attributed, in part, to an organization, policy, program or initiative. Results are not within the control of a single organization, policy, program or initiative; instead they are within the area of the organization's influence.

Statutory Expenditures: Expenditures that Parliament has approved through legislation other than appropriation acts. The legislation sets out the purpose of the expenditures and the terms and conditions under which they may be made.

Strategic Outcome: A long-term and enduring benefit to Canadians that is linked to the organization's mandate, vision and core functions.

Sunset Program: A time-limited program that does not have an ongoing funding and policy authority. When the program is set to expire, a decision must be made whether to continue the program. In the case of a renewal, the decision specifies the scope, funding level and duration.

Target: A measurable performance or success level that an organization, program or initiative plans to achieve within a specified time period. Targets can be either quantitative or qualitative.

Voted Expenditures: Expenditures that Parliament approves annually through an Appropriation Act. The Vote wording becomes the governing conditions under which these expenditures may be made.

Whole-of-government framework: Maps the financial contributions of federal organizations receiving appropriations by aligning their Programs to a set of 16 government-wide, high-level outcome areas, grouped under four spending areas.

Endnotes

i Justice Laws, http://laws.justice.gc.ca/eng/N-15/index.html
ii EUREKA, http://www.nrc-cnrc.gc.ca/eng/about/global/eureka.html
iii TRIUMF, http://www.triumf.ca/
iv Open Government, http://open.canada.ca/en/content/canadas-action-plan-open-government-2014-16
v Infotrieve, http://nsl-bsn.nrc-cnrc.gc.ca/eng/order/l
vi Whole-of-government framework, http://www.tbs-sct.gc.ca/ppg-cpr/frame-cadre-eng.aspx
vii Public Accounts of Canada 2015, http://www.tpsgc-pwgsc.gc.ca/recgen/cpc-pac/index-eng.html
viii NRC Aerospace, http://www.nrc-cnrc.gc.ca/eng/rd/aerospace/index.html
ix ALtec Consortium, http://www.nrc-cnrc.gc.ca/eng/solutions/collaborative/altec.html
x NRC AST, http://www.nrc-cnrc.gc.ca/eng/rd/ast/index.html
xi NRC OCRE, http://www.nrc-cnrc.gc.ca/eng/rd/ocre/index.html
xii NRC EME, http://www.nrc-cnrc.gc.ca/eng/rd/eme/index.html
xiii NRC Construction, http://www.nrc-cnrc.gc.ca/eng/rd/construction/index.html
xiv Genomics R&D Initiative, http://grdi-irdg.collaboration.gc.ca/eng/
xv Canadian Wheat Alliance, http://www.nrc-cnrc.gc.ca/eng/solutions/collaborative/wheat_index.html
xvi NRC ACRD, http://www.nrc-cnrc.gc.ca/eng/rd/aquatic/index.html
xvii NRC MD, http://www.nrc-cnrc.gc.ca/eng/rd/medical/index.html
xviii NRC Evaluations, http://www.nrc-cnrc.gc.ca/eng/about/planning_reporting/evaluation/index.html
xix NRC HHT, http://www.nrc-cnrc.gc.ca/eng/rd/hht/index.html
xx NRC-IRAP Concierge, http://www.nrc-cnrc.gc.ca/eng/irap/concierge/index.html
xxi NRC ICT, http://www.nrc-cnrc.gc.ca/eng/rd/ict/index.html
xxii NRC SDT, http://www.nrc-cnrc.gc.ca/eng/rd/security/index.html
xxiii NRC IRAP, http://www.nrc-cnrc.gc.ca/eng/irap/index.html
xxiv Thirty Meter Telescope, http://www.tmt.org/
xxv Square Kilometer Array Telescope, https://www.skatelescope.org/
xxvi NRC NSI, http://www.nrc-cnrc.gc.ca/eng/rd/nsi/index.html
xxvii NRC DPR, http://www.nrc-cnrc.gc.ca/eng/reports/2014_2015/dpr_index.html
xxviii Calibration Laboratory Assessment Service, http://www.nrc-cnrc.gc.ca/eng/solutions/advisory/clas_index.html
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